



MINERAL/WATER ANALYZER

In 1975, NASA launched what was to become one of the most successful space science missions ever conducted, the exploration of Mars by a team of four Viking spacecraft—two Viking Landers built by Martin Marietta Aerospace, Denver, Colorado and two Orbiters built by Jet Propulsion Laboratory. Among the complement of instruments aboard each of the Landers for photographing and investigating the planet's surface was an X-ray Fluorescence Spectrometer—developed for Langley Research Center by Martin Marietta Aerospace—that automatically analyzed the Martian soil and determined its composition. Modified versions of the instrument are finding Earth-use applications in geological exploration, water quality monitoring and aircraft engine maintenance.

X-ray fluorescence is a commonly used laboratory technique for determining the composition of samples. An x-ray source irradiates the sample, causing the sample to emit x-rays at various energies characteristic of the chemical elements in the sample. A spectrometer then measures the energy levels of the x-rays emitted for analysis of the sample's composition. The system designed by Martin Marietta Denver Aerospace for the Viking mission had to be highly miniaturized for compactness and extremely economical of power consumption. These qualities made it attractive for conversion to a portable Earth-use instrument.

A prototype unit was used successfully in analysis of subocean samples during a 1979 National Geographic expedition to the volcanic "vents" of the East Pacific Rise. The x-ray fluorescence system contributed important scientific data on the composition of copper, iron and zinc sulfide brought up from the sea floor in the first comprehensive study of the unique subocean phenomena in a region of high-temperature vents.

Subsequently, Langley Research Center and Martin Marietta modified the system to meet a Bureau of Mines need for a portable geological exploration unit. Shown undergoing field test at left and in closeup above, the system successfully demonstrated an ability to identify rapidly at least 60 elements—copper, uranium and tungsten, for example—and their relative concentrations in ore samples. Thus, potentially